

COLLEGE OF MEDICINE AND HEALTH SCIENCES ,DEPATMENT OF GENERAL SURGERY POSTGRADUATE PROGRAM

POSTOPERATIVE OUTCOME OF STOMA REVERSAL AND ASSOCIATED FACTORS AMONG ADULT PATIENTS WHO UMDERWENT STOMA REVERSAL AT THREE COMPREHENSIVE SPECIALIZED HOSPITALS IN CENTRAL ETHIOPIA REGION ,ETHIOPIA FROM 2020 - 2025

Thesis for Specialization In General Surgery

DR. MEBRATU ALAMIREW

February 2026
Wolkite University, Wolkite, Ethiopia



Wolkite University College of Medicine and Health Sciences Department of General Surgery Postgraduate Program

Postoperative Outcomes of Stoma Reversal and Associated Factors among Adult Patients who underwent Stoma reversal at the three Comprehensive Specialized Hospitals in the Central Ethiopia region, Ethiopia from 2020 to 2025

Thesis Submitted to College of Medicine and Health Sciences Department of General Surgery in Partial fulfillment of the Requirements for Specialty Certificate in General Surgery

Dr. Mebratu Alamirew (MD)

Advisors:

Dr. Abdi Beshir (MD, Assistant prof of General Surgery)

Mr. Andamlak Dendir (MPH, Assistant prof in Epidemiology)

APPROVAL SHEET

We hereby certify that we have read and evaluated this thesis entitled 'Postoperative Outcomes of Stoma Reversal and Associated Factors among Adult Patients who underwent stoma reversal at the three Comprehensive Specialized Hospitals in the Central Ethiopia region', prepared under our guidance by Dr. Mebratu Alamirew. We recommend that the Thesis shall be submitted as fulfilling the requirement for the award of Specialty Certificate in General surgery.

Advisors:

Clinical Advisor:

Dr. Abdi Beshir (MD, Ass't prof. in General surgery) Sign.  Date. 10/3/26

Puplic health Advisor:

Mr. Andamlak Dendir (MPH, Ass't in Epidemiology) Sign.  Date. 10/3/26

As a member of the Board of Examiners of the Medical Specialty program Thesis-Open Defense Examination, we have read and evaluated this Thesis prepared by Dr. Mebratu Alamirew and examined the candidate. We hereby certify that, the thesis is accepted for fulfilling the requirement for the award of **Specialty Certificate in General Surgery**.

Examiners

Dr. Abdulhey Hassen (MD, Ass't prof. in General Surgery) Sign.  Date. 10/3/26

Dr. Teshome Gensa (BSc, PhD in RH) Sign.  Date. 10/3/26

Department Head

Dr. Minower A/hadi Sign._____Date. _____

College Dean

Dr. Tesfaye Petros Sign._____Date. _____

Postgraduate Director

Name:_____Sign. _____Date. _____

DECLARATION

I hereby declare that this thesis is entirely my own original work. All sources of information used in the preparation of this thesis have been duly acknowledged and properly cited. I further declare that this thesis has not been submitted to any other institution for the award of any degree, diploma, or certificate.

Name: Mebratu Alamirew Signature:  Date: 10/3/26

ACKNOWLEDGMENT

I would like to thank WKU for giving me the chance to prepare this research Thesis. In addition, my special gratitude goes to Dr. Abdi Beshir and Mr. Andamlak Dendir for their valuable advice, comments, and suggestions throughout the preparation of this thesis.

I would like to extend my heartfelt appreciation to my beloved wife Dr. Samrawit Meshesha for her unwavering support, patience, and encouragement throughout the entire process of this work and my academic journey. I am deeply grateful for her love and support.

Finally, I would also like to thank all individuals who participate in my thesis preparation by showing direction and giving valuable information.

LIST OF ABBREVIATIONS AND ACRONYMS

AOR Adjusted Odd Ratio

ASA American Society of Anesthesiologist

COR Crude Odd Ratio

CI Confidence Interval

IQR Interquartile Range

NEMMCSH Nigist Eleni Mohammed Memorial Comprehensive Specialized Hospital

SSI Surgical Site Infection

VIF Variance Inflation Factor

WCSH Werabe Comprehensive Specialized Hospital

WKU Wolkite University

WKUCSH Wolkite University Comprehensive Specialized Hospital

TABLE OF CONTENTS

APPROVAL SHEET ii
DECLARATION iii
ACKNOWLEDGMENT iii
LIST OF ABBREVIATIONS AND ACRONYMS iv
TABLE OF CONTENTS v
LISTS OF TABLES iii
LISTS OF FIGURES iv
ABSTRACT vii
1. INTRODUCTION 1
1.1. Background 1
1.2. Statement of problem 2
1.3. Justification and Significance of the study 3
1.4. Objective 4
1.4.1. General objective 4
1.4.2. Specific objective 4
2. LITERATURE REVIEW 5
2.1. Postoperative Outcomes of stoma reversal 5
2.2. Factors associated of Outcome of stoma Reversal 6
2.3. Conceptual frame work 8
3. METHOD AND MATERIALS 9
3.1. Study area and period 9
3.2. Study design 10
3.3. Populations 10

3.3.1. Source population 10
3.3.2. Study population 10
3.4. Eligibility criteria 10
3.4.1. Inclusion criteria 10
3.4.2. Exclusion criteria 10
3.5. Sample size determination 10
3.6. Sampling techniques & procedures 11
3.7. Study variables 12
3.7.1. Dependent variable 12
3.7.2. Independent variable 12
3.8. Operational definitions 12
3.9. Data collection methods and Quality assurance 13
3.9.1. Data collection tools 13
3.9.2. Data collectors 13
3.9.3. Data collection procedure 13
3.10. Data Processing and Analysis 14
3.11. Ethical considerations 14
3.12. Dissemination 15
4. RESULTS 16
4.1. Socio-demographic characteristics 16
4.2. Pre-reversal clinical characteristics 16
4.3. Indications and Stoma characteristics 17
4.4. Time of stoma reversal and prophylaxis antibiotics 18

4.5. Postoperative outcome of stoma reversal 19

4.6. Risk factors associated with postoperative outcome of stoma reversal 20

5. DISCUSSION 24

6. STRENGTH AND LIMITATION 27

6.1. Strengths of the study 27

6.2. Limitations of the study 27

7. CONCLUSION AND RECOMMENDATION 28

7.1. Conclusion 28

7.2. Recommendation 28

8. REFERENCES 29

9. ANNEXES 32

9.1. Data Collection Checklist 32

LISTS OF TABLES

Table 1: Socio- demographic Characteristics of adult patients who underwent stoma reversal 16
Table 2: pre-operative clinical characteristics of adult patients who underwent stoma reversal 17
Table 3: Stoma characteristics 18
Table 4: Stoma type with stoma configuration 18
Table 5: Postoperative outcome of stoma reversal 20
Table 6: Bivariate Logistic Regression Analysis of Factors Associated with complications. 21
Table 7: Multivariable logistic regression analysis of factors associated with complications. 23

LISTS OF FIGURES

Figure 1: Conceptual framework for Study proposed on Treatment outcome of Stoma Reversal, in Public hospitals. (Source: Constructed by the investigator after reading different literatures on stoma reversal surgeries)..... 8
Figure 2 : Source and study population 11
Figure 3 : Indications of stoma formation 17

ABSTRACT

Background: Intestinal stoma reversal is performed to restore bowel continuity and improve quality of life. However, it carries substantial morbidity and mortality. Reported morbidity ranges from 10% to 52.1%, and mortality may reach 10%. Despite these risks, local evidence regarding postoperative outcomes and associated factors in Central Ethiopia remains limited.

Objectives: To assess postoperative outcome of stoma reversal and identify associated factors among adult patients who underwent stoma reversal in selected hospitals in Central Ethiopia from 2020 to December 2025.

Methods: An Institution-based multicenter retrospective cross sectional study was conducted among adult patients who underwent stoma reversal between 2020 and 2025. Data were collected using a structured checklist from medical records, entered into EpiData 4.7, and analyzed using SPSS version 26 for analysis. Binary logistic regression analysis was performed to identify factors associated with postoperative complications. Variables with p-value < 0.05 in multivariate analysis were considered statistically significant.

Results: Of 229 patients who underwent stoma reversal, 185 met the inclusion criteria and were analyzed. Overall postoperative complication rate was 35.1%. Surgical site infection was the most common complication, accounting for 60.9% of all complications. The 30-day postoperative mortality rate was 6.5%. In multivariate analysis, increasing age (AOR=10.8, 95%CI: 2.48-16.68), delayed time to reversal (AOR=6.583 , 95% CI: 1.524-11.282), delayed admiration of prophylaxis (AOR=10.12, 95% CI: 1.82-22.54), the presence of comorbidity (AOR=5.019, 95% CI: 1.076 -23.404) were independently associated with postoperative complications

Conclusion: Postoperative complications following stoma reversal remain common, affecting 35.1% of patients. Optimizing perioperative care and timely reversal may help reduce adverse outcomes.

Key words: Stoma reversal, postoperative complications, surgical site infection, multicenter study, Central Ethiopia

1. INTRODUCTION

1.1. Background

Intestinal stoma is the exteriorization of either the small bowel (ileostomy) or large bowel (colostomy) through the anterior abdominal wall to divert fecal content to the external surface of the body. It is one of the most commonly performed life-saving surgical procedures worldwide and plays a crucial role in the management of congenital and acquired gastrointestinal conditions(1)(2).

Despite its life-saving role, stoma creation is associated with significant complication rate, ranging from 25% to 75% (3).

Consequently, stoma reversal defined as the surgical restoration of bowel continuity by anastomosing the proximal and distal bowel segments, is performed to improve quality of life and eliminate stoma related morbidities. There are different types of reversal configuration including end to end, end to side or side to side and the technique of anastomosis can be hand suture (double layer or single layer) or stapling(4).

Current guidelines generally recommend stoma reversal within 2-3 months following initial surgery, though emerging evidence suggests that early closure in selected patients may be performed without increasing morbidity(5).

Although stoma reversal improves patient quality of life, it carries considerable postoperative risks of complications includes: surgical site infection, wound dehiscence, anastomotic leak, prolonged ileus, adhesive intestinal obstruction, and mortality. Several studies have identified predictive factors for postoperative complications, including advanced age, comorbidities, surgical technique, timing of reversal, and perioperative management (6).

1.2. Statement of problem

Globally, stoma reversal procedures demonstrate wide variability in morbidity and mortality rates. Reported morbidity rates for colostomy reversal range from 10% to 52.1%, with higher rates frequently observed in low-income settings. Reversal following complex procedures such as Hartmann's procedure has been associated with particularly high morbidity, exceeding 50% in some studies(7)(8). Mortality rates vary geographically, ranging from 1.4 % to 7.6%(8)(9).

Common postoperative complications include surgical site infection, anastomotic leak, wound dehiscence, ileus and bowel obstruction (8)(10).

Outcomes following stoma reversal depend on multiple factors, including patient characteristics, comorbidities, surgical technique, timing of closure, and perioperative care(11)(12). Studies from African countries, including South Africa, have reported complication rates of approximately 17% following ileostomy closure. Additional risk factors such as fascia dehiscence, subcutaneous fat thickness, stoma type, and surgical approach have also been implicated(13).

In Ethiopia, limited evidence exists regarding postoperative outcomes and associated factors of stoma reversal. A study conducted in Addis Ababa reported complication rates (19.5%) and some associated factors; however, it was limited to urban teaching hospitals and may not reflect outcomes in other regions of the country(14). To date, there is insufficient evidence from Central Ethiopia. Therefore, this study was designed to assess postoperative outcomes and identify associated factors among patients undergoing stoma reversal in selected hospitals in Central Ethiopia, thereby addressing both geographic and empirical gaps.

1.3. Justification and Significance of the study

Stoma creation and reversal are frequently performed surgical procedures in Ethiopia. However, evidence regarding postoperative outcomes and associated risk factors remains limited, particularly outside major urban centers. Most available studies originate from other countries or different healthcare settings, which may not reflect local clinical practice, resource availability, and patient characteristics.

Generating region-specific data is essential for improving perioperative management and surgical outcomes. By identifying the magnitude of postoperative complications and associated risk factors in Central Ethiopia, this study provides evidence that can guide clinical decision-making, optimize timing and technique of stoma reversal, and facilitate early identification of high-risk patients and other factors associated with the outcome.

Furthermore, the findings may support hospital administrators and policymakers in improving surgical quality, strengthening perioperative protocols, and allocating resources effectively. The study also contributes to the limited national literature on stoma reversal outcomes and may serve as a reference for future research in similar low-resource settings.

1.4. Objective

1.4.1. General objective

To assess postoperative outcomes of stoma reversal and identify associated factors among adult patients who underwent stoma reversal at WKUCSH, NEMMCSH, and WCSH in the Central Ethiopia region from January 1, 2020 to December 30, 2025. The data were collected from January 10 to February 20/2026.

1.4.2. Specific objective

To determine the magnitude of postoperative outcome of stoma reversal among adult patients who underwent stoma reversal in selected hospitals.

To identify factors associated with poor postoperative outcome of stoma reversal among adult patients who underwent stoma reversal in selected hospitals.

2. LITERATURE REVIEW

2.1. Postoperative Outcomes of stoma reversal

Postoperative complications following stoma reversal are a significant concern worldwide, with morbidity rates ranging from 10% to 52.1% and mortality up to 7.6%. Recent studies demonstrate that complication rates vary depending on stoma type, surgical technique, timing of reversal, and patient comorbidities.

Several studies from Europe, Asia, and South America have reported varying morbidity and mortality rates after stoma reversal.

In Spain, a multicenter retrospective study of 161 patients reported an overall morbidity rate of 35.5% (95% CI: 28.1–42.9), with a 2% operative mortality rate, and surgical wound infection being the most common complication occurring in 18.4% of cases (15).

Similarly, in the United Kingdom, a retrospective study of 146 patients reported that 52.1% of patients developed at least one postoperative complication (95% CI: 44.0–60.2) with a 30-day mortality rate of 1.4%, and postoperative ileus requiring nasogastric decompression was the most frequent complication (8).

A retrospective cohort study from Germany including 161 patients reported an overall postoperative complication rate of 49% (95% CI: 41.3–56.7). Surgical site infections occurred in 18%, anastomotic leakage in 3.8%, and surgical re-exploration in 11.2%, while medical complications including pneumonia (2.5%) and urinary tract infections (1.3%) were also observed (16).

In Korea, postoperative complications occurred in 35.9% of patients, with ileus being the most frequent complication (13.3%), followed by superficial or deep surgical site infections (9.4%), incisional hernia (8.6%), and organ/space surgical site infection (3.9%) (17).

In Pakistan, a retrospective study involving 96 patients reported that 41.6% experienced postoperative complications (95% CI: 31.8–51.4), most commonly wound infection (19.8%) and incisional hernia (15.6%)(10) .

A retrospective analysis from Brazil involving 39 patients found postoperative complications in 25.6% of patients (95% CI: 11.9–39.3), with anastomotic leakage being the most notable complication, and three deaths representing a mortality rate of 7.6% (9).

In India, a study conducted among 50 patients reported postoperative complications in 48% of cases (95% CI: 34.1–61.9). The most common complications were obstruction (41.66%), wound infection (33.33%), and wound dehiscence (25%) (18).

In Tanzania, a prospective descriptive cross-sectional study involving 194 patients reported postoperative complications in 40.2% (95% CI: 33.3–47.1), with deep and organ/space surgical site infections accounting for 26.8% of cases (19).

In Ethiopia, a retrospective study conducted in Addis Ababa among 87 patients reported a complication rate of 19.5% (95% CI: 11.2–27.8), with wound infection and anastomotic leakage each occurring in 4.6% of patients (14).

Other studies focusing on ileostomy reversal reported lower complication rates. In Italy, a study of 145 patients reported an overall morbidity rate of 13.1% (95% CI: 7.6–18.6), including ileus (5.5%), small bowel obstruction (2%), bleeding (2.7%), and wound infection (2.2%) (20).

Similarly, in China, a retrospective study of 439 patients reported an overall complication rate of 11.4% (95% CI: 8.4–14.4) following ileostomy reversal (7).

2.2. Factors associated of Outcome of stoma Reversal

Several studies identified factors influencing postoperative morbidity after stoma reversal.

Studies in Spain Advanced age was identified as a significant risk factor for poor postoperative outcomes ($p < 0.001$) (15), in Korea Factors associated with higher postoperative morbidity included older age ($p=0.001$), comorbidities, complex or emergency surgery, prolonged operative time, prior abdominal surgery, and use of immunosuppressive medications (17) .

In Brazil, ASA grade, index indication for colostomy, anastomotic configuration, and anastomotic technique were not significant predictors of postoperative complications ($p = 0.55, 0.53, 0.82, 0.46$, respectively) (9).

In Turkey, age and sex were not significant predictors, and emergency surgery, stoma type, and stoma configuration were also not associated with morbidity. However, higher preoperative ASA score and the presence of coronary artery disease ($p=0.024$) were significant risk factors. Prolonged hospital stay was also associated with complications, while preoperative hemoglobin and timing of stoma closure showed no significant association (11).

In Pakistan, longer duration of stoma before closure (p=0.044) and higher ASA score were significantly associated with postoperative morbidity and mortality, while stoma type, closure technique, and age were not (21). Timing of stoma closure was a key factor in Slovenia and Germany. In Slovenia, closure within 8 months after the primary surgery was associated with lower complication rates ($p < 0.05$) (6). In Germany , early closure within 150 days was associated with lower overall and mild postoperative complication rates, whereas late closure ($p < 0.001$) increased ileus and diarrhea or stool incontinence (22). In India, late stoma closure (61–70 days) had higher complication rates than early closure (31–40 days) (18) .

Reported in UK factors associated with poorer outcomes included older age, frailty, higher comorbidity burden (ASA ≥3), immunosuppression, socio-economic deprivation, and delayed timing of reversal. ($p < 0.001$) (8), in Germany delayed in stoma closure ($p = 0.002$) increased complication rate (22), whereas, in Korea (AOR=0.5) delayed in reversal > 6 months decreased in complications (17).

Other patient-related factors included comorbidities, which were associated with complications in Italy (OR 4.49, $p = 0.05$) (20), and another study in Italy reported hypertension ($p = 0.036$), advanced age ($p = 0.048$), ASA >2 ($p = 0.028$), and previous stoma complications ($p = 0.048$) were significantly associated with the complications (23)

In China, lower preoperative albumin ($p < 0.01$), greater intraoperative blood loss ($p = 0.017$), and longer operative times ($p < 0.01$) were predictors of postoperative complications (7).

In Korea, retrospective study reported associated between prophylaxis antibiotic use and surgical site infection is that the relative risk (RR) of SSI in patients who received their first PA more than 1 hour before incision was significantly higher than for those who received it within 1 hour prior to incision (RR=8.20, 95% CI=4.81-13.99). Inappropriate PA selection increased SSI rate, albeit with marginal significance (RR=1.97, 95% CI=0.96-4.03) (24).

2.3. Conceptual frame work

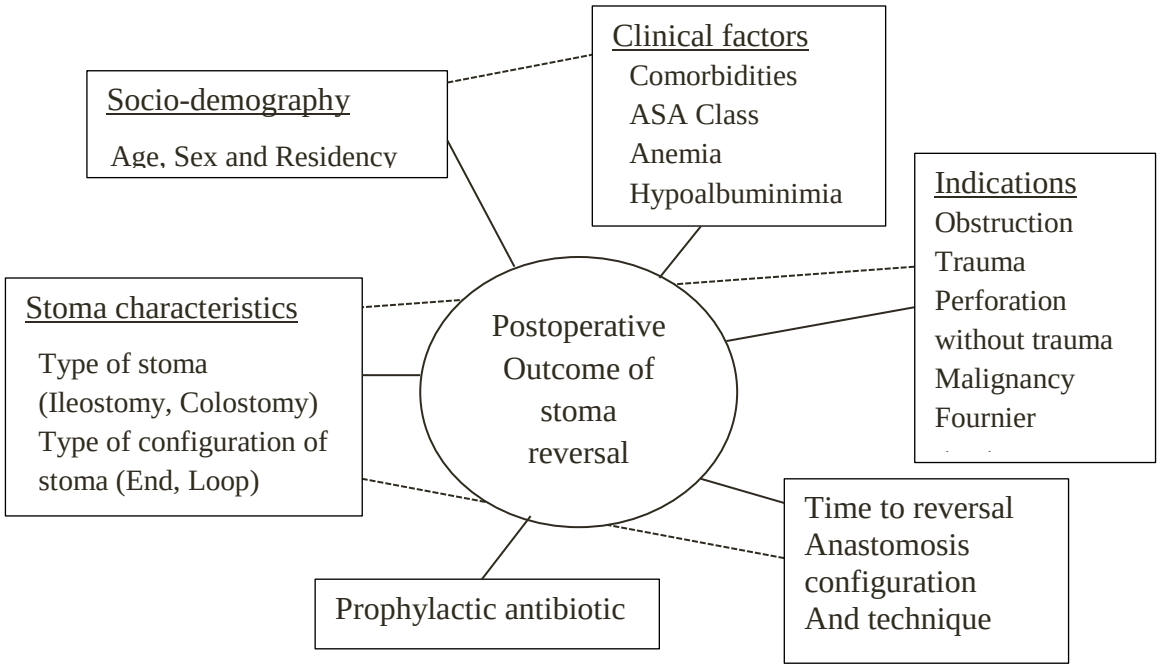


Figure 1: Conceptual framework for Study on Treatment outcome of Stoma Reversal, in Public hospitals. (Source: Constructed by the investigator after reading different literatures on stoma reversal surgeries)

3. METHOD AND MATERIALS

3.1. Study area and period

This study was conducted at WKUCSH, NEMMCSH, and WCSH, which are located in the Central Ethiopia region, one of the newly established regional states of Ethiopia. The administrative capital of the region is Hosana town. The region was officially formed in 2023, following the reorganization of the former Southern Nations, Nationalities, and peoples' region. Geographically, it is bordered by the Oromia Region to the north, east, and west, the Sidama Region to the southeast, and the Southern Ethiopia Region to the South.

WKUCSH is located in Wolkite town, the administrative capital of the Gurage Zone, approximately 155 km southwest of Addis Ababa. It is a teaching and referral hospital under WKU, serving as a major center for advanced medical care and surgical interventions for the surrounding population.

NEMMCSH is located in Hosana town, the capital of Hadiya Zone and the administrative center of the Central Ethiopia Regional State, approximately 232 km southwest of Addis Ababa. It is one of the largest referral and teaching hospital in the region, affiliated with Wachamo University, providing medical and surgical services to a wide catchment area.

WCSH is located in Werabe town, the administrative capital of Silte Zone, about 174 km south of Addis Ababa. It is a growing referral hospital providing medical and surgical services to the population of Silte Zone and neighboring areas.

These three hospitals were strategically selected as study sites, because they are the main referral centers in the Central Ethiopia Region, offering comprehensive surgical services, including stoma creation and reversal procedures. They serve populations from multiple Zones, ensuring that the study findings are representative of the region. The data were collected from January 10 to February 20/2026.

3.2. Study design

Institutional - based multicenter retrospective cross sectional study was conducted.

3.3. Populations

3.3.1. Source population

All patients who underwent stoma reversal at WKUCSH, NEMMCSH, and WCSH from 2020 to December 2025 were the source population of this study.

3.3.2. Study population

All patients from the source population who fulfilled the inclusion criteria were included.

3.4. Eligibility criteria

3.4.1. Inclusion criteria

All patients who underwent stoma reversal from January 1, 2020 to December 30, 2025 at WKUSH, NEMMCSH, and WCSH were included in the study.

3.4.2. Exclusion criteria

All cases with incomplete medical records or missed medical records, patients for whom stoma reversal was done at other facilities and having follow-up in these hospitals and patients younger than 15 years old were excluded from the study.

3.5. Sample size determination

Sample size was calculated by using a single population proportion formula by considering the following assumptions: taking the proportion of postoperative outcomes of a study conducted in two teaching hospitals in Addis Ababa, Ethiopia(14), (p=19.5%) 2sided 95% confidence interval and 5% margin of error. Accordingly, the calculated sample size was 242.

$$n = \frac{z^2 * p(1-p)}{d^2}$$

n = required sample size

z = z – score corresponding to the desired confidence level (i.e. 95% = 1.96)

P = Estimated proportion from previous study done in Addis Ababa (19.5%)

d= margin of error (5%)

$$n = \frac{(1.96)^2 * 0.195(1-0.195)}{(0.05)^2} = \frac{3.8416 * 0.195 * 0.805}{0.0025} = \frac{0.603}{0.0025} = 242$$

3.6. Sampling techniques & procedures

However, since the study was conducted with retrospectively review of medical records, the total number of patients who underwent stoma reversal at the three selected comprehensive hospitals from January 2020 to December 30, 2025 was 229. As the available cases were smaller than the calculated sample size, a total sampling technique was employed. Accordingly, all 229 medical records were reviewed.

After applied the predefined inclusion and exclusion criteria, 185 eligible patient records were included in the final analysis.

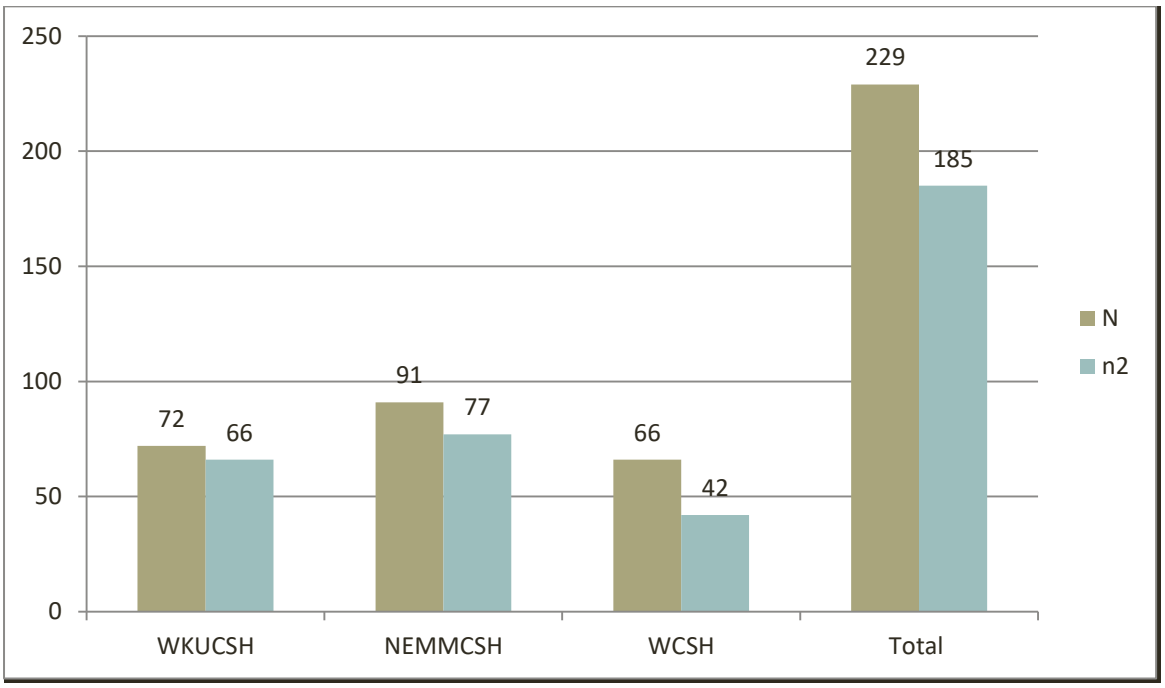


Figure 2 : Source and study population

3.7. Study variables

3.7.1. Dependent variable

Postoperative outcome of stoma reversal

3.7.2. Independent variable

The explanatory variables were: Socio-demographic variables (age, sex, residency), indications for stoma creation (Intestinal obstruction, trauma, perforation without trauma, malignancy, Fournier gangrene), type of stoma (Colostomy, Ileostomy, both) and construction (loop, end), timing of reversal, configuration of anastomosis (End to End, End to Side, Side to side), techniques of anastomosis (Single layer, double layer), timing of prophylaxis antibiotic administration, hypoalbuminemia, anemia, comorbidities and ASA score.

3.8. Operational definitions

Postoperative Outcome is refers to the result or consequences of surgical procedures after operation has been performed. It categorized as: Good outcome refers to patient has no complication after operation within 30 days. Whereas, Poor outcome refers to the occurrence of one or more complications including: Surgical site infection, Wound dehiscence, ileus or intestinal obstruction, Anastomotic leak or stricture, Enterocutanous fistula and mortality within 30 days post operation.

Early stoma reversal is defined as stoma reversal within 3 months, whereas delayed stoma reversal refers to reversal after 6 months of stoma creation.

Prophylactic Antibiotic is drugs that should be given to the patient before skin incision. It should within 60 minutes before surgical incision and only give once, unless required.

Hypoalbuminemia is defined as a serum albumin level < 3.5 g/dL.

Anemia is defined as hemoglobin < 13 g/dL to male or < 12 g/dL to female

3.9. Data collection methods and Quality assurance

3.9.1. Data collection tools

The structured checklist was developed after an extensive review of previously published studies on stoma reversal and postoperative outcomes. Variables that were consistently reported across the literatures were identified and incorporated into the tool to ensure relevance and completeness. The standard operational definitions for clinical variables were adopted from clinical criteria and prior researches to enhance comparability. The checklist was carefully reviewed and refined to ensure clarity, consistency and alignment with the study objectives before data collection began.

3.9.2. Data collectors

Training was provided for two days six BSC nurses and three general practitioners who served as data collectors and supervisors. The training covered the objectives of the study, detail review of the data extraction checklist, standardized operational definitions of variables, and procedures for reviewing medical records (charts) and handling of collected data to ensure completeness, consistency, and accuracy

3.9.3. Data collection procedure

Six BSC nurses were conducted the data collection process. They were assigned to review medical records of patients and complete the structured data extraction checklist. All data collection activities were supervised by the trained general practitioners and the principal investigator daily to ensure completeness, consistency, and accuracy of the collected data. Any error, missing values, or inconsistencies identified during supervision were corrected immediately.

The data were entered into EpiData version 4.7 using double data entry verification to ensure accuracy before being exported to SPSS software for analysis.

The reliability of the data collection process was ensured through comprehensive training of data collectors, use of standardized operational definitions, close daily supervision, and double data entry verification. These measures minimized inter-observer variation and data entry errors.

Content validity of the data collection tool was ensured through extensive review of relevant literature and adoption of standard clinical definitions. The checklist was reviewed and refined to ensure inclusion of all relevant variables and alignment with the study objectives.

3.10. Data Processing and Analysis

The verified data in EpiData version 4.7 were exported to SPSS version 26 for coding, cleaning, and analysis. Descriptive statistics were used to summarize the study variables. Categorical variables were presented as frequencies and percentages, and Tables and figures were used to present results.

Bivariate logistic regression analysis was performed to identify candidate variables associated with poor postoperative outcomes of stoma reversal. Variables with a p-value < 0.25 in the bivariate analysis were included in the multivariate binary logistic regression model to control for potential confounders. Multicollinearity among independent variables was assessed using the Variance Inflation Factor (VIF) and tolerance values, and the model fitness was evaluated using the Hosmer-Lemeshow test (p=1.00).

In the final multivariate analysis, variables with a p-value < 0.05 were considered statistically significant. Adjusted Odds Ratios with their corresponding 95% Confidence Intervals were calculated to determine the strength and direction of association between independent variables and the dependent variable

3.11. Ethical considerations

Ethical clearance was obtained from the Wolkite University Institutional Health Research Ethics Review Committee. An official letter requesting cooperation and permission was then submitted to the administrations of WKUCSH, NEMMCSH, WCSH, and the regional health bureau.

A brief explanation of the study objectives and data collection procedures was provided, and information sheets along with voluntary informed consent forms were given to the heads of the hospitals. After receiving permission, patient charts that met the inclusion criteria were selected for review. Confidentiality of the collected data was strictly maintained, and patient names were not recorded during data collection.

3.12. Dissemination

The final results of this study will be presented to Wolkite University as part of the final research defense for partial fulfillment of the requirements for Degree of Master of Medicine in General Surgery. The findings will also be summited to the WKU College of Medicine and Health Science, as well as to WKUCSH, NEMMCSH, WCSH, the regional health bureau, and Ministry of Health. Additionally, the study will be prepared for peer review and submission to reputable scientific journals for publication.

4. RESULTS

4.1. Socio-demographic characteristics

During the study period, 229 patients underwent stoma reversal, of whom 185 patients met the inclusion criteria and were included in the analysis. The mean age of the patients was 44.5 ± 16.4 years, ranging from 16 to 80 years and the majorities were within 31-60 years. A Majority of patients were male, accounting for 69.2% (n=128) of the study population. More than half of the patients, 55.7% (n=103), resided in rural areas **(Table 1).**

Table 1: Socio- demographic Characteristics of adult patients who underwent stoma reversal (n=185)

Variables	Category	Frequency (n)	Percent (%)
Age (years)	15-30	47	25.4
	31-45	57	30.8
	46-60	52	28.1
	>60	29	15.7
Sex	Male	128	69.2
	Female	57	30.8
Residency	Urban	82	44.3
	Rural	103	55.5

4.2. Pre-reversal clinical characteristics

The majority of patients were classified as ASA I, accounting for 116 (62.7%), while 66 (35.7%) were ASA II. Comorbidities were present in 29.2% (n = 54) of patients, with hypertension and diabetes mellitus being the most common, each affecting 30.3% (n = 20) of those with comorbidities. Anemia was observed in 25.4% (n = 47) of patients, and hypoalbuminemia in 14.1% (n = 20). Additionally, 5.9% (n = 11) of patients had both anemia and hypoalbuminemia (**Table 2).**

Table 2: Pre reversal clinical characteristics

Variable	Category	Frequency	Percent
ASA Class	I	131	70.8
	II	48	25.9
	III	6	3.2
Comorbidities	No	130	70.3
	Yes	55	29.7
Type of comorbidity	DM	20	30.3
	HTN	20	30.3
	CKD	8	12.1
	COPD	7	10.6
	Cardiac disease	11	16.7
Anemia	No	138	74.6
	Yes	47	25.4
Hypoalbuminemia	No	122	85.9
	Yes	20	14.8

4.3. Indications and Stoma characteristics

The most common indication for stoma formation was intestinal obstruction, accounting for 105 (56.8%) cases. Perforation without trauma and trauma each accounted for 37 (20.0%) patients, while malignancy and Fournier gangrene were uncommon indications as shown in (**Figure 3).**

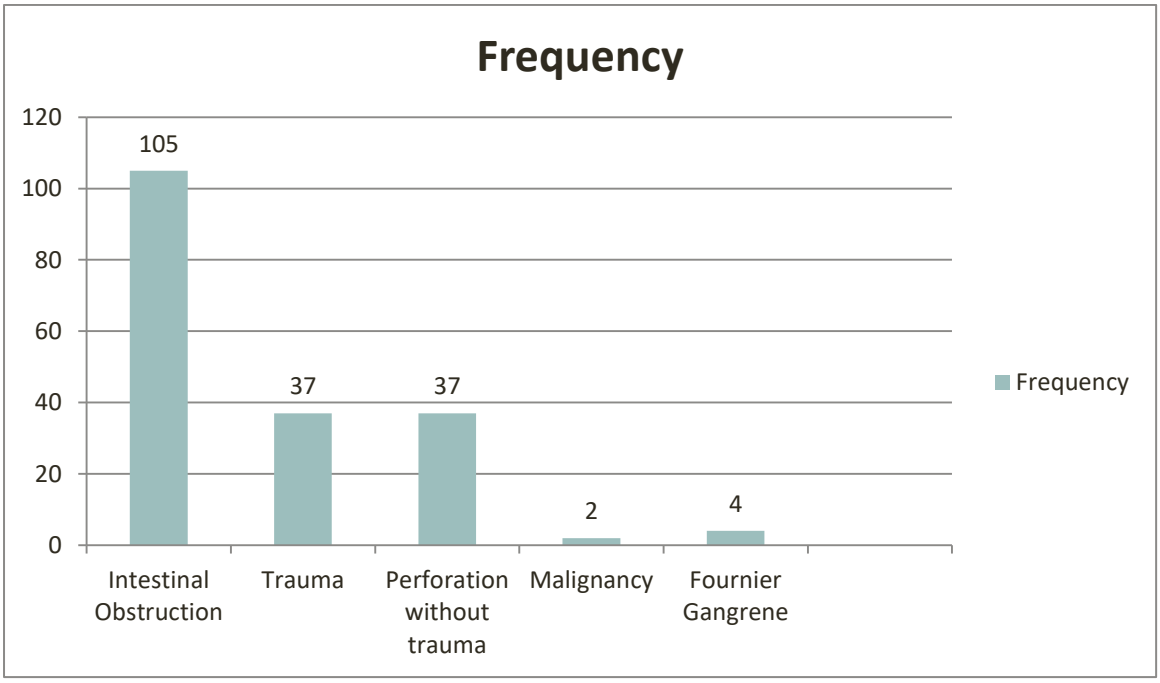


Figure 3 : Indications of stoma formation (n=185)

The most common type of stoma was Colostomy, performed in 116 patients (62.7%), end colostomy was the common configuration type (80.2%); followed by ileostomy in 60 (32.4%) and, 90.0% ileostomy was end ileostomy. Both ileostomy and colostomy were performed in 9 patients (4.9%). Among patients with both types of stomas, 8 (88.9%) were end stomas and 1 (11.1%) was a loop stoma. Generally, the majority of patients had an end stoma, accounting for 155 (83.8%) cases, while loop stomas were performed in 30 patients (16.2%) as shown in (Table 4) and (Table 5).

Table 3: Stoma characteristics (n=185)

Variables	Category	Frequency	Percent
Stoma type	Ileostomy	60	32.4
	Colostomy	116	62.7
	Both	9	4.9
Configuration	End	155	83.8
	Loop	30	16.2

Table 4: Stoma type with stoma configuration

Stoma type	End n(%)	Loop n(%)	Total n(%)
Colostomy	93(83.2)	23(19.8)	116(62.7)
Ileostomy	54(90.0)	6(10.0)	60(32.4)
Both	8(88.9)	1(11.1)	9(4.9)
Total	155(83.8)	30(16.2)	185 (100.0)

4.4. Time of stoma reversal and prophylaxis antibiotics

The interval from the stoma creation to stoma reversal ranges from 2 weeks to 39 weeks, majority of stoma reversal surgery is done between 8 – 16 weeks (67.0%), (23.2) reversed between 17 – 24 weeks and the remaining (5.4%), (4.3%) reversed before 8 weeks and after 24 weeks respectively. The common reversal configuration was end to end anastomosis (85.9%) by using double layer hand sewn anastomosis technique in about 82.2% of patients (Table 5)

All patients received prophylactic antibiotics. 94.6% of patients took prophylaxis antibiotic was within 60 minutes..

Table 5: perioperative factors

Variables	Category	Frequency	Percent
Time of stoma reversal(weeks)	< 8	10	5.4
	8 - 16	124	67.0
	17 - 24	43	23.2
	> 24	8	4.3
Configuration of Anastomosis	E-E	158	85.9
	E-S	26	14.1
Technique of anastomosis	Single layer	33	17.8
	Double layer	151	82.2
Duration of prophylaxis(Minutes)	≤ 60	175	94.6
	> 60	10	5.4

4.5. Postoperative outcome of stoma reversal

This study showed (64.9%) of patients who underwent stoma reversal surgeries had good postoperative outcome, while the rest had poor postoperative outcome 35.1% (n=65). Among patients with poor outcome, a total of 87 complications were recorded, as some patients developed more than one complication. The most common complication was surgical site infection (SSI), occurring in 60.9% patients. This was followed by anastomotic leak in 21.7% patients, wound dehiscence in 17.4% patients, postoperative ileus in 17.4%, and postoperative adhesion in 8.7% patients.

Among patents that had poor postoperative outcomes, 53 patients (30.6%) were recovered, while 11 patients (4.5%) were died within 30 days and also there was one patient on table death. Accordingly, the overall 30-days postoperative reversal mortality rate was 6.5%.

Majority of patients (64.3%) had prolonged hospital stay post reversal with the range of 0 to 21 days. Re-admission within 30 days after surgery was 6.5 % (n=12).

Table 6: Postoperative outcome of stoma reversal

Variable	Category	Frequency	Percent
Presence of complications	Yes	65	35.1
	No	120	64.9
Type of complications (multiple response)	SSI	42	60.9
	Anastomotic leak	15	21.7
	Wound dehiscence	12	17.4
	Ileus	12	17.4
	Postop adhesion	6	8.7
Re-admission within 30 days	Yes	12	6.5
	No	172	93.5
Postop hospital stay (days)	≤ 8 days	96	35.7
	>8 days	119	64.3

4.6. Risk factors associated with postoperative outcome of stoma reversal

Bivariate logistic analysis was performed to assess the association between potential risk factors and poor postoperative outcome of stoma reversal.

Statistically significant associations were observed with advanced age (COR = 13.270, 95% CI: 4.336 - 20.614, $p < 0.001$), comorbidities (OR=5.171, 95% CI: 2.627 -10.178, $p < 0.001$), ASA Class ≥ II (COR= 3.429, 95% CI: 1.769 – 6.645), duration of prophylaxis (COR =19.125, 95% CI: 2.365 -15.663, $p < 0.006$).

However, factors with $p < 0.25$ such as anemia, hypoalbuminemia, time of stoma reversal and anastomotic configuration were included in multivariate binary logistic analysis as shown in **(Table 7)**.

In the final model of multivariate binary logistic regression analysis, age greater than 60 years, the presence of comorbidities, delay stoma reversal beyond 24 weeks, and delayed administration of prophylaxis antibiotics more than 60 minutes were independently associated with poor postoperative outcomes. Thus, Patients older than 60 years had

about 10.8 times higher likelihood developing of poor outcome compared with those aged 15 to 30 year (AOR=10.8, 95% CI: 2.479-16.68 p=0.002). Similarly, patients with comorbid conditions were five times more likely to develop poor outcomes than those without comorbidity(AOR=5.019.95% CI: 1.076-23.404,p=0.04) Reversal performed after 24 weeks was also associated with 6.6 times increased risk of developing poor postoperative outcomes compared to reversal within 8 weeks (AOR=6.58,95% CI: 1.524-11.28,p=0.027). In addition, delayed in receiving prophylactic antibiotics for more than 60 minutes increased the risk by about ten times (AOR=10.123, 95%CI: 1.820-22.537,P= 0.014),as shown in (**Table 8).**

Table 7: Bivariate Logistic Regression Analysis of Factors Associated with complications

Variables	Category	Outcomes		COR	95% C.I.		p-value
		Good(n,%)	Poor(n,%)		Lower	Upper	
Age(year)	15-30	36(80.9)	9(19.1)	1			< **0.001**
	31-45	38(66.7)	19(33.3)	2.111	0.848	5.254	
	46-60	37(71.2)	15(28.8)	1.712	0.667	4.392	
	> 60	7(24.1)	22(75.9)	13.270	4.336	20.614	
Sex	Male	82(64.1)	46(35.9)	1			0.732
	Female	38(66.7)	19(33.3)	0.891	0.461	1.722	
Residency	Urban	51(62.2)	31(37.8)	1			0.498
	Rural	69(67.0)	34(33.0)	1.234	0.673	2.262	
Comorbidity	No	99(76.2)	31(23.8)	1			<**0.001**
	Yes	21(38.2)	34(61.8)	5.171	2.627	10.178	
ASA class	I	96(73.3)	35(26.7)	1			<**0.001**
	≥II	24(44.4)	30(55.6)	3.429	1.769	6.645	
Anemia	No	94(68.1)	44(31.9)	1			**0.114**
	Yes	26(55.3)	21(44.7)	1.726	0.876	3.397	
Hypo-alb	No	80(65.6)	42(34.4)	1			**0.185**
	Yes	10(50)	10(50)	1.905	.735	4.939	

Table 8: Table 7: Bivariate Logistic Regression Analysis of Factors Associated with complications (continuous--

Variable	Category	Outcome		COR	95% CI		p-value
		Good(n,%)	Poor(n,%)		Lower	Upper	
Indications	Obstruction	67(63.8)	38(36.2%)	1			0.679
	Perforation without trauma	21(56.8)	16(43.2)	1.343	0.627	2.880	
	Trauma	27(73.0)	10(27.0)	0.653	0.285	1.494	
	Fournier gangrene	3(75.0)	1(25.0)	0.588	0.059	5.850	
Stoma type	Ileostomy	37(61.7)	23(38.3)	1			0.385
	Colostomy	40(34.5)	76(65.5)	0.781	0.448	1.363	
Configuration	End	100(64.5)	55(35.5)	1			0.821
	Loop	20(66.7)	10(33.3)	0.909	0.397	2.079	
Time of reversal(week)	< 8	7(70)	3(30)	1			**0.132**
	8 -16	85(68,5)	39(31.5)	0.143	0.018	1.161	
	17 -24	26(60.5)	17(39.5)	0.153	0.030	0.792	
	>24	2(25.0)	6(75.0)	0.218	0.039	1.209	
Anastomosis configuration	E –E	106(66.7)	53(33.3)	0.583	0.252	1.349	**0.208**
	E-S	14(53.8)	12(46.2)	1			
Anastomosis technique	Single layer	22(66.7)	11(33.3)	1.102	0.497	2.444	0.812
	Double layers	98(64.5)	54(35.5)	1			
Duration of Prophylaxis/minute	≤ 60	119(68.0)	56(32.0)	1			**0.006**
	>60	1(10.0)	9(90.0)	19.125	2.365	15.663	

Table 9: Multivariable logistic regression analysis of factors associated with complications

Variables	Category	AOR	95% C.I.		P-value
			Lower	Upper	
ASA Class	I	1			0.870
	≥II	0.879	0.188	4.116	
Age (Year)	15-30	1			
	31-45	1.396	0.376	5.188	
	46-60	1.478	.394	5.549	
	> 60	10.758	2.479	16.686	**0.002**
Comorbidity	Yes	5.019	1.076	23.404	**0.040**
Anemia	Yes	0.784	0.263	2.339	0.662
Hypoalbumenimia	Yes	1.788	.492	6.491	0.377
Time of stoma reversal(weeks)	< 8	1			
	8 -16	1.654	0.130	21.011	0.698
	17 - 24	3.695	0.257	13.060	0.336
	> 24	6.583	1.524	11.282	**0.027**
Duration of prophylaxis(In minutes)	> 60	10.123	1.820	22.537	**0.014**
Anastomosis configuration	End to End	0.646	0.204	2.043	0.457

5. DISCUSSION

This study assessed postoperative outcome of stoma reversal and associated factors at WKUCSH, NEMMCSH, and WCSH in central Ethiopia. The overall magnitude of poor postoperative outcome of stoma reversal was 35.1%, indicating that stoma reversal is associated with considerable morbidity in our setting. Surgical site infection was frequently observed complication. Furthermore, advanced age, presence of comorbidity, delayed in stoma reversal and delayed administration of prophylaxis antibiotics was found to be independent factors of poor postoperative outcome.

In the present study, the overall magnitude of postoperative complications following stoma reversal was 35.1% (95% CI: 28.2–42.0), indicating a considerable level of postoperative morbidity. This finding is comparable with studies conducted in Spain 35.5% (95% CI: 28.1–42.9) (15) and Korea 35.9% (95% CI: 27.6–44.2) (17), the overlapping confidence intervals across these studies suggest that the observed differences are unlikely to be statistically significant. This similarity may indicate that stoma reversal inherently carries a moderate risk of postoperative complications regardless of geographic setting.

Conversely, the complication rate in this study is lower than that reported in the United Kingdom 52.1% (95% CI: 44.0–60.2) (8) and Germany 49% (95% CI: 41.3–56.7) (16).The limited or absent overlap between the confidence intervals suggests that the complication rates in those studies may be meaningfully higher than in the present study. Similar trends are observed in Pakistan 41.6% (95% CI: 31.7–51.4) and India 48% (95% CI: 34.2–61.8) (10)(18), although some overlap of confidence intervals indicates that the difference may be less pronounced. These variations may be attributed to differences in patient demographics, underlying disease severity, surgical indications for stoma formation, timing of stoma reversal, and perioperative management practices, which can influence postoperative outcomes.

In contrast, the complication rate in the present study is higher than that reported in Brazil 25.6% (95% CI: 11.9–39.3) (9), Italy 13.1% (95% CI: 7.6–18.6), China 11.4% (95% CI: 8.4–14.4) (20)(7). The limited or absent overlap of the confidence intervals in these comparisons suggests that the higher complication rate observed in this study is statistically meaningful. Clinically, this may reflect differences in patient characteristics, including comorbidity burden and nutritional status, as well as institutional factors such

as surgical technique, timing of stoma reversal, perioperative care, and available resources.

Within the African context, the postoperative complication rate in this study (35.1%, 95% CI: 28.2–42.0) is slightly lower than that reported in Tanzania 40.2% (95% CI: 33.3–47.1) but higher than in a previous Ethiopian study 19.5% (95% CI: 11.2–27.8) (19) (14). The overlapping confidence intervals with Tanzania suggest no statistically significant difference, whereas minimal overlap with the earlier Ethiopian study indicates a meaningful increase in complications. This likely reflects differences in sample size, surgical techniques, perioperative care, and institutional practices, emphasizing that even within the same region, clinical management, and patient selection influence postoperative morbidity.

In the present study, patients older than 60 years had 10.8 times higher odds of developing postoperative complications compared to those aged 15–30 years (AOR=10.8, 95% CI: 2.479–16.68, p=0.002). This finding is consistent with previous studies from Spain ($p < 0.001$) (15), Korea ($p = 0.001$) (17), and Italy ($p = 0.048$) (23), which also reported advanced age as a significant predictor. The increased risk may be attributed to decreased physiological reserve, slower wound healing, and higher comorbidity burden in older patients, highlighting the need for careful preoperative assessment and optimization in elderly populations.

Patients with comorbid conditions were five times more likely to develop postoperative complications than those without comorbidities (AOR=5.019, 95% CI: 1.076–23.404, p=0.04). Supporting evidence comes from Turkey ($p = 0.024$) (11) and Italy ($p = 0.05$) (20), which also demonstrated that comorbidities significantly increase postoperative risk. Comorbid conditions can impair immune function, reduce healing capacity, and increase susceptibility to both surgical and medical complications, emphasizing the importance of perioperative optimization and risk stratification.

Delayed stoma reversal, defined as reversal performed after 24 weeks, was associated with a 6.6 fold increased risk of postoperative complications compared to reversal within 8 weeks (AOR=6.583, 95% CI: 1.524–11.28, p=0.027). Similar associations have been reported in the United Kingdom ($p < 0.001$) (8), Germany ($p = 0.002$) (22), Pakistan ($p = 0.044$) (21), and Slovenia ($p < 0.05$) (6). Delayed reversal may result in adhesions, bowel inflammation, and increased technical difficulty during surgery, which predispose to

complications. Interestingly, a study in Korea found that reversal beyond 6 months was associated with reduced complications (AOR=0.5) (17), suggesting that patient selection and perioperative optimization may modify this risk.

Delayed administration of prophylactic antibiotics for more than 60 minutes prior to incision increased the risk of postoperative complications by approximately ten-fold (AOR=10.123, 95% CI: 1.820–22.537, p=0.014). A similar finding was reported in Korea, where administration more than 1 hour before incision increased the risk of surgical site infection (RR=8.20, 95% CI: 4.81–13.99) (17). Timely and appropriate prophylactic antibiotic administration is crucial for preventing surgical site infections, particularly in stoma reversal where bowel manipulation and contamination are common.

These results emphasize the importance of timely stoma reversal, optimized perioperative management**,** and strict adherence to antibiotic protocols to reduce postoperative morbidity.

6. STRENGTH AND LIMITATION

6.1. Strengths of the study

Multicenter study improves generalizability within Central Ethiopia

Multivariate analysis identified independent predictors of postoperative complications, enhancing analytical rigor

6.2. Limitations of the study

Retrospective design limits causal inference and relies on medical record completeness

Important variables such as nutritional status, BMI, smoking history, and detailed intraoperative findings were inconsistently recorded

Findings may not generalize to regions with differing healthcare resources

7. CONCLUSION AND RECOMMENDATION

7.1. Conclusion

35.1% of patients experienced postoperative complications after stoma reversal, with surgical site infection as the most common. Advanced age, delayed reversal, delayed administration of prophylaxis, and presence of comorbidity was independent predictors of poor outcomes, highlighting the need for optimized perioperative care and timely surgical intervention.

7.2. Recommendation

Prioritize early evaluation and timely stoma reversal

Standardize perioperative antibiotic protocols to prevent delays or prolongation

Optimize patient condition before reversal, including management of comorbidities

Strengthen postoperative monitoring and infection prevention strategies

Hospitals should be maintain complete medical records of their patients

Conduct prospective studies to further evaluate risk factors and long-term outcomes

8. REFERENCES

1. Massenga A, Chibwae A, Nuri AA, Bugimbi M, Munisi YK, Mfinanga R, et al. Indications for and complications of intestinal stomas in the children and adults at a tertiary care hospital in a resource-limited setting: A Tanzanian experience. BMC Gastroenterol. 2019 Aug 28;19(1).

2. Martin ST, Vogel JD. Intestinal Stomas. Indications, Management, and Complications. Vol. 46, Advances in Surgery. 2012. p. 19–49.

3. Park JJ, Del Pino A, Orsay CP, Nelson RL, Pearl RK, Cintron JR, et al. Stoma complications: The Cook County Hospital experience. Dis Colon Rectum. 1999;42(12):1575–80.

4. Info A. Different types of anastomotic methods : a review of literature. 2015;2(4):178–81.

5. O'Sullivan NJ, Temperley HC, Nugent TS, Low EZ, Kavanagh DO, Larkin JO, et al. Early vs. standard reversal ileostomy: a systematic review and meta-analysis. Vol. 26, Techniques in Coloproctology. Springer Science and Business Media Deutschland GmbH; 2022. p. 851–62.

6. Krebs B, Ivanecz A, Potrc S, Horvat M. Factors affecting the morbidity and mortality of diverting stoma closure. Radiol Oncol. 2019;53(3):331–6.

7. Lv Q, Shu XP, Peng D, Li SQ, Xiang Z. Predictors of complications after prophylactic ileostomy reversal for rectal cancer: A retrospective study. World J Gastrointest Surg. 2024 May 27;16(5):1354–62.

8. Macdonald S, Gallagher A, Mcnicholl L, Mcelroy L, Hughes R, Quasim T et. a. Stoma reversal after emergency stoma formation the importance of timing. World J Emerg Surg [Internet]. 2025;20(26):2–12. Available from: https://doi.org/10.1186/s13017-025-00598-3

9. Fonseca AZ, Uramoto E, Santos-Rosa OM, Santin S, Ribeiro M. Colostomy closure. Arq Bras Cir Dig. 2017 Oct 1;30(4):231–4.

10. Khan S, Alvi AR, Awan Z, Rashid NH, Khan S, Alvi A. Morbidity of colostomy reversal [Internet]. Vol. 66, JPMA: Journal of Pakistan Medical Association. 2016. Available from: http://ecommons.aku.edu/pakistan_fhs_mc_surg_surg

11. Kilinc G, Ustun M, Tuncer K, Sert I. Risk factors for the morbidity and mortality of stoma closure. J Coll Physicians Surg Pakistan. 2021 Sep 1;31(9):1085–8.

12. Vergara-Fernández O, Trejo-Avila M, Salgado-Nesme N. Multivariate analysis of risk factors for complications after loop ileostomy closure. Cir y Cir (English Ed. 2019 May 1;87(3):337–46.

13. Paik B, Kim CW, Park SJ, Lee KY, Lee SH. Postoperative outcomes of stoma takedown: Results of long-term follow-up. Ann Coloproctol. 2018 Oct 1;34(5):266–70.

14. Bekele A, Kotisso B, Biluts H. Outcomes of Colostomy Reversal Procedures in Two Teaching Hospitals in Addis Ababa, Ethiopia [Internet]. Available from: http://www.bioline.org.br/js119

15. Roig JV, Salvador A, Frasson M, García-Mayor L, Espinosa J, Roselló V, et al. Stoma Reversal After Surgery for Complicated Acute Diverticulitis. Cirugía Española (English Ed. 2018 May;96(5):283–91.

16. Antolovic D, Reissfelder C, Özkan T, Galindo L, Büchler MW, Koch M, et al. Restoration of intestinal continuity after Hartmann's procedure-not a benign operation. Are there predictors for morbidity? Langenbeck's Arch Surg. 2011 Oct;396(7):989–96.

17. Kang JH, Kang BM, Yoon SN, Kim JY, Park JH, Oh BY, et al. Analysis of factors affecting reversal of Hartmann's procedure and post-reversal complications. Sci Rep [Internet]. 2020;10(1):1–8. Available from: https://doi.org/10.1038/s41598-020-73791-w

18. Modi JV, Suthar N, Trivedi M. Clinical study of stoma closure: its complications and management. Int Surg J. 2023 Sep 28;10(10):1637–41.

19. Mbelle PJ, Kizigina S, Mwashambwa M. Indications for Stoma Creation and Early Outcome Predictors of Stoma Closure at Universtiy of Dodoma Teaching Hospitals. Int J Biomed Res Pr. 2024;4(2):1–12.

20. Peltrini R, Magno G, Pacella D, Iacone B, Rizzuto A, Bracale U, et al. Postoperative Morbidity Following Loop Ileostomy Reversal after Primary Elective or Urgent Surgery: A Retrospective Study with 145 Patients. J Clin Med. 2023 Jan 1;12(2).

21. Kumar D, Karim S, Ullah S, Hanif M, Rasheed Zai A, Aqil Razzaq M. Association of Risk Factors for the Mortality and Morbidity of Stoma Closure. Pakistan J Med Heal Sci. 2021 Nov 30;15(11):3153–4.

22. Werner JM, Kupke P, Ertl M, Opitz S, Schlitt HJ, Hornung M. Timing of Closure of a Protective Loop-Ileostomy Can Be Crucial for Restoration of a Functional Digestion. Front Surg. 2022 Mar 28;9.

23. Rizzo G, Ferrara F, Parini D, Pata F, Forni C, Anania G, et al. Timing and morbidity of loop ileostomy closure after rectal cancer resection. Int J Colorectal Dis. 2025;40(1).

24. Sakong P, Lee JS, Lee EJ, Ko KP, Kim CH, Kim Y, et al. Association between the pattern of prophylactic antibiotic use and surgical site infection rate for major surgeries in Korea. J Prev Med Public Heal. 2009;42(1):12–20.

9. ANNEXES

9.1. Data Collection Checklist

Study title: Postoperative Outcomes of Stoma Reversal and Associated Factors among Adult Patients who underwent stoma reversal at Three Comprehensive Specialized Hospitals in Central Ethiopia (January 2020–Dec 2025)

Instructions for data collectors

Complete this checklist for every eligible patient who underwent stoma reversal between 2020 and Dec 2025. Use the patient's medical records(chart)

Enter categorical responses by ticking (√) or writing the specified code. Record numerical values where asked.

If data are missing, write "NA" and note reason if available

Administrative details

Study ID: _____

Hospital: _____ (1 = WKUCSH, 2 = NEMCSH, 3 = WCSH)

Socio-demographic variables

Age (years): _____

Sex: (0) Male (1) Female

Residence: (0) Urban (1) Rural

Preoperative clinical variables

Comorbidities: (0) N0 (1) Yes

Types of comorbidities (tick all that apply):

(0) Diabetes mellitus (1) Hypertension (2) Cardiac disease (3) COPD/Asthma (4) chronic kidney disease

ASA score : (0) I (1) II (2) III (3) IV

Anemia: (0) No (1) Yes (If hgb <13 /M & < 12/F)

Hypoalbuminemia: (0) No (1) Yes (define per protocol (e.g., <3.5 g/dL)

Stoma-related variables

Primary indication for initial stoma creation (tick one):

(0) Intestinal obstruction (1) Perforation without trauma

(2) Trauma (3) Malignancy (4) Fournier gangrene

Type of stoma: (0) Ileostomy (1) Colostomy (2) both

Stoma configuration: (0) Loop (1) End

Intraoperative / surgical variables

Time of reversal (from stoma creation to reversal) _____

Type of anastomosis configuration: (0) End-to-end (1) End-to-side (2) Side-to-side

Technique of anastomosis: (0) Hand-sewn single layer (1) Hand-sewn double layers

Use of prophylactic antibiotic before incision: (0) No (1) Yes

If yes: antibiotic name: _____ Time given (minutes before incision): _____

Post-postoperative variables

Postoperative ICU admission: (0) No (1) Yes

Postoperative length of hospital stays (days): _____

Any postoperative complication including death: (0) No (1) Yes

Type of Postoperative complications within 30 days (tick all that apply):

(0) Surgical site infection (SSI) (1) Anastomotic leak (2) Wound dehiscence

(3) Postoperative ileus (4) adhesion obstruction

Readmission within 30 days: (0) No (1) Yes

Alive at 30 days post-op: (0) No (1) Yes

Operational / data quality checks

Are all key items (Demographics Character, Preop labs, Operation notes, Discharge note , postop course and others) available in the chart? (0) No (1) Yes

If data missing, specify which: _____